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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 059291

June 1970

U.S. Training and
Employment Service
Technical Report
S-13

Development of USTES

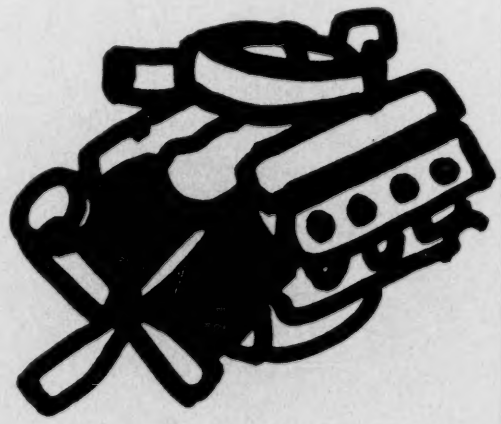
APTITUDE TEST BATTERY FOR

GASOLINE-ENGINE ASSEMBLER
(engine & turbine)
806.781

INTERNAL-COMBUSTION-ENGINE-ASSEMBLER
(engine & turbine)
806.781

OUTBOARD-MOTOR ASSEMBLER
(engine & turbine)
806.781

U.S. DEPARTMENT OF LABOR
Manpower Administration



TM 001 182

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Gasoline-Engine Assembler (engine & turbine) 806.781
Internal-Combustion-Engine Assembler (engine & turbine) 806.781
Outboard-Motor Assembler (engine & turbine) 806.781

S-13

(Developed in Cooperation with the Minnesota
and Wisconsin State Employment Services)

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U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #616,712, 766

Development of USTES Aptitude Test Battery

For

Gasoline-Engine Assembler (engine & turbine) 806.781-026
Internal-Combustion-Engine Assembler (engine & turbine) 806.781-026
Outboard-Motor Assembler (engine & turbine) 806.781-026

S-13

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupations of Gasoline-Engine Assembler (engine & turbine) 806.781-026, Internal-Combustion-Engine Assembler (engine & turbine) 806.781-026, and Outboard Motor Assembler (engine & turbine) 806.781-026. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
P - Form Perception	80
K - Motor Coordination	75
F - Finger Dexterity	75
M - Manual Dexterity	85

Research Summary-Validation

Sample:

59 (45 female and 14 male) workers employed as Outboard-Motor Assemblers in Minnesota and Wisconsin.

This study was conducted prior to the requirement of providing minority group status. Therefore, minority group composition is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .53 ($P/2 < .0005$)

Effectiveness of Norms:

Only 75% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 91% would have been good workers. Twenty-five percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 9% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	75%	91%
Poor Workers	25%	9%

SAMPLE DESCRIPTION

Size:

N=59

Occupational Status:

Employed Workers.

Work Setting:

Workers were employed by Scott-Atwater Manufacturing Company, Inc., Minneapolis, Minnesota and the National Pressure Cooker Company, Eau Claire, Wisconsin.

Employer Selection Requirements:

Age: Ages 18 through 40 preferred.

Education: None required.

Previous Experience: None required.

Tests: None used.

Other: Personal interview and physical examination

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least one month job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age and Experience.

	Mean	SD	Range	r (Minn.) N=33	r (Wisc.) N=26
Age (years)	27.0	5.5	19-40	.205	-.150
Experience (months)	22.4	25.2	1-96	.032	-.132

No education data were available for the Minnesota sample.

EXPERIMENTAL TEST BATTERY

The tests of the GATB, B-1001, except Part E, were administered in 1952. All scores have been converted to equivalent B-1002 scores.

CRITERION

The criterion for each subsample consisted of broad category supervisory ratings based on the quality and quantity of work performed. Since the criteria for both samples were broad category ratings, the two subsamples were combined.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 25% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers."

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
S - Spatial Aptitude	Required to visualize the function of each part and the position of each part on the motor.
P - Form Perception	Required to recognize quickly the shape of parts to be assembled.
K - Motor Coordination	Required to position parts quickly and accurately, insert screws and apply small tools for fastening.
F - Finger Dexterity	Required to pick up, manipulate and assemble small parts, washers, screws, and nuts and to manipulate small hand tools.
M - Manual Dexterity	Required to move arms and hands rapidly in picking up parts, handling wires, and positioning parts for assembly and in handling hand and power tools.

TABLE 4

Means, Standard Deviation (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=59

	Mean	SD	Range	r (Minn.) N=33	r (Wisc.) N=26
G-General Learning Ability	93.4	14.6	65-123	.135	.566**
V-Verbal Aptitude	92.4	14.6	67-124	.128	.432*
N-Numerical Aptitude	90.7	15.1	49-116	.047	.593**
S-Spatial Aptitude	101.4	19.4	62-154	.000	.454*
P-Form Perception	103.5	17.4	68-140	.075	.629**
Q-Clerical Perception	92.1	12.4	64-123	.425*	.562**
K-Motor Coordination	93.4	16.9	60-132	.448**	.636**
F-Finger Dexterity	106.0	20.1	53-145	.132	.608**
M-Manual Dexterity	108.8	20.9	68-169	.372*	.700**

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important				X	X		X	X	X
Irrelevant									
Relatively High Mean					X			X	X
Relatively Low Standard Dev.	X	X				X			
Significant Correlation with Criterion (Wisc.)	X	X	X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q, K, F, and M at trial cutting scores were able to differentiate between the 75% of the sample considered to be good workers and the 25% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less that one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Co-efficient was used as a basis for comparing trial norms. Norms of P-80, K-75, F-75 and M-85 provided optimum differentiation for the occupations of Gasoline-Engine Assembler (engine & turbine) 806.781-026, Internal-Combustion-Engine Assembler (engine & turbine) 806.781-026, Outboard-Motor Assembler (engine & turbine) 806.781-026. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .53 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
P-80, K-75, F-75 and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	6	38	44
Poor Workers	11	4	15
Total	17	42	59

Phi Coefficient = .53 Chi Square (X^2_y) = 16.6
Significance Level = $P/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-51 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .38 is obtained with OAP-51 norms of P-85, K-80 and M-80.

CHECK STUDY RESEARCH SUMMARY SHEET FOR S-13

S-13 GATB Study #766

Gasoline-Engine Assembler (engine & turbine) 806.781-026
Internal-Combustion-Engine Assembler (engine & turbine) 806.781-026
Outboard-Motor Assembler (engine & turbine) 806.781-026

Check Study # 1 Research Summary

Sample:

45 female applicants for work at the Power Products Corporation, Sheboygan, Wisconsin

This study was conducted prior to the requirement of providing minority group status. Therefore, minority group composition is unknown.

TABLE 7

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Aptitudes of the GATB. N=45

	Mean	SD	Range	r
Age (years)	34.4	7.3	18-46	-.090
Education (years)	10.3	2.0	7-16	.232
G-General Learning Ability	92.1	15.3	69-140	.303*
V-Verbal Aptitude	95.9	14.9	71-135	.151
N-Numerical Aptitude	91.4	15.2	61-124	.285*
S-Spatial Aptitude	93.6	19.5	57-134	.290*
P-Form Perception	96.0	19.3	52-140	.297*
Q-Clerical Perception	97.5	15.7	63-143	.237
K-Motor Coordination	97.6	20.0	62-154	.342*
F-Finger Dexterity	99.9	20.4	53-134	.523**
M-Manual Dexterity	98.5	21.7	45-144	.444**

*Significant at the .05 level.
**Significant at the .01 level.
B-1001 scores converted to equivalent B-1002 scores.

Criterion:

Supervisory rating collected in 1953.

Design:

Predictive (testing was done prior to applicants being hired and criterion data were collected after applicants had at least one month job experience.)

Concurrent Validity:

Phi coefficient = .45 ($P/2 < .005$)

Effectiveness of Norms:

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-13 norms, 83% would have been good workers. Thirty-three percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-13 norms, only 17% would have been poor workers. The effectiveness of the norms when applied to this independent sample is shown graphically in Table 8:

TABLE 8

Effectiveness of S-13 Norms
on Check Study Sample # 1

	Without Tests	With Tests
Good Workers	67%	83%
Poor Workers	33%	17%

TABLE 9

Concurrent Validity of S-13 Norms
on Check Study Sample # 1

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	25	30
Poor Workers	10	5	15
Total	15	30	45

Phi coefficient = .45 Chi Square (X^2_y) = 9.1

Significance Level - $P/2 < .005$

FACT SHEET

Job Title

Gasoline-Engine Assembler (engine & turbine) 806.781-026
Internal-Combustion-Engine Assembler (engine & turbine) 806.781-026
Outboard-Motor Assembler (engine & turbine) 807.781-026

Job Summary

Works as a member of assembly line crew performing any of a variety of assembly operations in the building of outboard-motors.

Work Performed

Minnesota Sample: Performs various operations in assembling outboard-motor parts on a production line. Bolt cylinders, magnetos, carburetors, gasoline tanks and propellers to motor blocks; scrape, file, and ream connecting rods and main bearings, bolt caps, loosen or tighten bolts to adjust for fit; press wrist-pin bushings into pistons using arbor press, and install piston rings with hand compressor; install spark plugs and high tension wiring; assemble parts of automatic re-winding starters and propeller parts; apply decalcomonia designs on painted gasoline tanks, motor skirts and side of motor assembly as directed. May be assigned to any one or any group of tasks described, and may assemble carburetors, magnetos, propellers or other sub-assembly units. May be assigned to single or multiple drill-press operations.

Wisconsin Sample: Works as a member of progressive assembly line crew performing any of a variety of assembly operations in the building of outboard-motors.

Assembles power head units by inserting pistons and connecting rods, crankshaft, valves, and ball bearings into head chamber, fastening parts, adding gaskets and attaching cover plates with screws. Attaches bracket, inserts key in shaft slot, connects power head to electric motor and gives power head special break-in run. Fastens carburetor and carburetor controls to power head using gaskets, nuts, and screws. Attaches power head unit to lower unit of motor, inserts spark plugs and attaches holding bracket. Assembles magnets to power head, connects electrical wires and adjusts gaps in magnets. Attaches and adjusts motor sturring and control handle. Test runs assembled units by mounting on test tank, attaching gasoline hose, starts motor and runs it for specified time, listening and observing for faulty operation, adjusting carburetor, tightening magnetos and injecting break-in oil. Replaces spark plugs, attaches gas line and gas control valves, and slips rubber shields on wires. Assembles gas tank and starter cover to power head. Aligns tank and tightens gas line. (Motor is then given final inspection by inspector and defective motors are sent to repairman.) Attaches shrouds to motor with nuts and bolts, applies decals to gas tank, wipes off motor, inserts literature, and packs

in cardboard cartons for shipping. Uses variety of hand and power tools such as power screw driver, tension and other wrenches, hammer, pliers, file and hand screw drivers. May place work in jog or fixture for assembly. Visually inspects parts being assembled and rejects defective materials.

Effectiveness of Norms

Validation Sample:

Only 75% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-13 norms, 91% would have been good workers. Twenty-five percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-13 norms, only 9% would have been poor workers.

Cross Validation Sample:

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-13 norms, only 83% would have been good workers. Thirty-three percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-13 norms, only 23% would have been poor workers.

Applicability of S-13 Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

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